WHAT IS CLAIMED IS:

1. A method for making high performance epoxies, comprising the steps of:

a) preparing a solution of clay particles;

b) dispersing the solution of clay particles; and

c) mixing a resulting dispersed clay particles solution;

whereby a pristine epoxy is incorporated during one of steps a), b) and c), particles of nano-dimensions in a resulting epoxy being finely and homogeneously distributed, yielding a high-performance epoxy.

2. The method according to claim 1, wherein said step a) of preparing a solution of clay particles comprises incorporating clay particles of a dimension in a nanometer range in a liquid solution.

3. The method according to any one of claims 1 and 2, wherein said step a) of preparing a solution of clay particles comprises incorporating clay particles and a solvent.

4. The method according to any one of claims 1 to 3, wherein said step a) of preparing a solution of clay particles comprises mixing with at least one of mechanical and ultrasonic mixing.

5. The method according to any one of claims 1 to 4, wherein said step b) comprises submitting the clay solution to a shearing flow under a high pressure gradient and a high velocity and to breaking impacts in a region of obstacle, and to a reduced pressure.

6. The method according to claim 1, wherein the pristine

epoxy is incorporated during step b) and said step b) comprises exfoliating the clay particles in the solution.

7. The method according to any one of claims 1 to 6, wherein said step c) comprises mixing the dispersed clay particle solution with the pristine epoxy and curing agents to yield a solid epoxy material.

8. The method according to any one of claims 1 to 7, whereby the high performance epoxy comprises agglomerates of less than about 1 μm and agglomerates of a maximum diameter comprised between about 1 μm and 2 μm.

9. The method according to any one of claims 1 to 8, whereby the high performance epoxy has enhanced viscoelastic properties, improved fracture toughness, and critical strain energy release rate.

10. The method according to claim 9, whereby the high performance epoxy has increase in K_{1C} and G_{1C} of up to 2 and 8 times respectively with respect to the pristine epoxy, at about 1 wt % of clay loading.

11. The method according to any one of claims 1 to 9, whereby the high performance epoxy has enhanced barrier properties, including water absorption resistance, adhesion strength and flammability resistance.

12. The method according to any one of claims 1 to 10, wherein a mixture of clay and epoxy obtained has a stability over an extended period of time.

13. The method according to claim 1, wherein said incorporating the pristine epoxy comprises incorporating a rubber-modified epoxy resin.

14. A system for making a high performance epoxy from a pristine epoxy, comprising:

a first container for preparing a solution of clay particles;

a device for dispersing the solution of clay particles; and

a second container for mixing a dispersed solution of clay particles;

wherein said device for dispersing the solution of clay particles comprises a first section submitting the solution of clay particles to a high pressure gradient and a high velocity; a second section of obstacle; and a pressure-collapse chamber; an output solution from said device having a fine and homogeneous distribution of clay particles of nano-dimensions.

15. The system according to claim 14, wherein the solution of clay particles comprises the pristine epoxy and curing agents.

16. The system according to claim 14, wherein the pristine epoxy is incorporated in the solution of clay particles in one of said first container, said chamber and said second container.

17. The system according to any one of claims 14 to 16, wherein said section of obstacle submits the solution of clay particles to breaking impacts.

18. The system according to any one of claims 14 to 17, wherein the pristine epoxy is a rubber-modified epoxy.

19. The system according to any one of claims 14 to 18, wherein the solution of clay particles comprises additives.

20. A high performance epoxy produced following the method of any one of claims 1 to 13.

21. A high epoxy produced by using the system of any one of claims 14 to 19.

22. An improved epoxy made from a pristine epoxy, comprising clay agglomerates of less than about 1 μm and agglomerates of a maximum diameter between about 1 μm and 2 μm finely dispersed in the pristine epoxy.

23. The improved epoxy according to claim 22, wherein a content of clay agglomerates at about 1 wt % of clay loading yield an increase in a fracture toughness, with an increase in K_{1C} and G_{1C} of up to 2 and 8 times with respect to the pristine epoxy respectively.

24. The improved epoxy according to any one of claims 22 and 23, wherein said pristine epoxy is a rubber-modified epoxy.

25. The improved epoxy according to any one of claims 22 to 24, further comprising additives to the clay and to the pristine epoxy.

26. A use of the improved epoxy according to any one of claims 22 to 25 in a field selected in the group consisting of aircraft industry, automobile industry, sport equipment manufacturing, adhesive and sealant

manufacturing, wood products, coatings and manufacturing of components for pipes, boats and reservoirs; transportation, train and space industries.